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Valeria Stagno, PhD student
Earth Sciences Department, Sapienza University of Rome, Piazzale Aldo Moro 5, 00185, Rome, Italy
Phone/FAX: +39-06-49913928
E-mail: valeria.stagno@uniroma1.it

To the Editor of ACTA IMEKO Journal

Dear Editor,

Please find enclosed the manuscript entitled:

"Decay of a Roman age pine wood studied by micro-MRI, diffusion-NMR and portable NMR" by V. Stagno et al., submitted for publication in your journal as "full length".

In this paper, we present an updated and improved version of the original one already published in the Proceedings of IMEKO Conference 2020. Our work is based on the evaluation of the decay of a Roman age wood (*Pinus Pinea* L.) and on its microstructural characterization by using Nuclear Magnetic Resonance (NMR). The high-field NMR study of our archaeological wood exploits both the potential of MR Imaging (MRI) in observing diagnostic characters and artefacts reconstructing the decay distribution of the whole sample and of diffusion-NMR in providing parameters (i.e. tortuosity and diffusion coefficient) able to characterize the wood topology, such as pore size, cell wall permeability and wood structural complexity. Furthermore, since non-destructiveness is a prior need in the Cultural Heritage world, we also tested the feasibility of portable NMR relaxation analyses for calculating the wood pore size and highlighting the effect of age on wood porosity. All the analyses were also performed on a modern wood of the same species. By comparing the ancient and the modern pine, it was possible to show that decay mostly occurred in rays and latewood cell walls with also loss of the ancient wood structural complexity. Moreover, the result about the enlargement of the pores lumen in the archaeological sample obtained by low-field portable NMR was confirmed and validated by high-field NMR. MR images also revealed morphological aspects, such as the annual rings, which can inform about past climate changes.

The authors would now indicate the major points of the extension:

a) Introduction: the manuscript introduction has been updated and references of the same topic that exist in the recent literature have been added.
b) Theory section: a completely new section of theory has been added in order to point out and compare the two methods used for the pore size calculation. The first method is based on the possibility of computing pore size from diffusion coefficient measurements, the second one from transversal relaxation measurements.
c) Methods section: a new subsection about the low-field measurements has been added. Further analyses of both MRI and high-field T_1 relaxation were performed and described.
d) Results and discussion sections:
    1. Study of wood by using MRI: compared to the previous version where only two images (radial and transversal section) for each sample were presented, this new version has been updated with a third image obtained in the tangential section for both the woods. Then, a complete histology of the samples was provided.
    2. High-field NMR analyses: the measurement of the longitudinal relaxation time (T_1) was performed and discussed with the aim of optimizing the choice of the observation time Δ for diffusion analyses, according to the relation $\Delta < T_1$.
    3. Diffusion analyses: the range of Δ was rescaled and an improved trend of Dx vs. Δ was obtained. This upgrade also allowed to optimize the pore size computation.

4. Portable NMR analyses: a completely new section based on the measurement of the transversal relaxation time (T_2) by using a low-field portable NMR mouse has been added. The T_2 measurements were then used to calculate the pore size by inverting the T_2 distribution.

e) Conclusion: conclusion section has been updated and adapted to the new results achieved.
f) References: the manuscript has been supported by introducing a large number of new references concerning the research topic.

I declare that there are no conflicts of interest and that the manuscript has not been submitted simultaneously to another journal for consideration. I have read and understood your journal's policies. Declarations of interest: none.

On behalf of all the contributors, I am the corresponding author. All authors have agreed to the manuscript submission.

Regards,

Valeria Stagno